A NEW LEATHERFLOWER (*CLEMATIS*: RANUNCULACEAE) FROM THE SOUTHERN APPALACHIANS

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ABSTRACT

Clematis vinacea sp. nov., a new, narrowly endemic species of *Clematis* subg. *Viorna* is described and illustrated from the southern Appalachian Mountains of the southeastern United States. Its relationship to *C. crispa*, based on habit, morphology, and phenology is discussed. Its limited distribution is discussed in relation to the Walden Creek geologic formation to which it seems restricted.

RIASSUNTO

Clematis vinacea sp. nov., una nuova, specie strettamente endemiche di *Clematis*, sottogenere *Viorna* è descritto ed illustrato dalle Appalachi meridionali del sud-est degli Stati Uniti. Il suo rapporto con *C. crispa*, sulla base di abitudine, morfologia e fenologia è discusso. Sua distribuzione limitata è discusso in relazione alla formazione geologica Walden Creek cui sembra ristretta.

INTRODUCTION

Several populations of a *Clematis* L. (Ranunculaceae) with affinities to *C. crispa* L. were observed growing on shale talus slopes in the Ocoee River Gorge in Polk County, southeast Tennessee; an unusually dry habitat for *C. crispa*. The plants were vining through neighboring vegetation with flowers at the terminus of each stem, but lacked the broadly crispate sepal margins seen in *C. crispa*. Plants observed during anthesis in early spring bore an uncanny foliar and habit resemblance to the western North American *C. hirsutissima* Pursh. These plants were erect, the lower leaves reduced to linear-lanceolate segments, and the inflorescence was terminal and single-flowered with pinkish-purple, sericeous sepals. The three to five pairs of opposite leaves were highly divided and densely sericeous on both surfaces. Additional observations later in the season showed that the plant can continue to grow from axillary buds at the base of the terminal inflorescence. When edaphic conditions, i.e., abundant soil moisture, are present throughout the season the plant continues growing whereupon the habit becomes vine-like.

Examination of herbarium materials at TENN shows that *Clematis vinacea* has long been confused with the Appalachian forms of *C. viorna* L. which are glabrous in comparison to the pubescent forms encountered in the Interior Low Plateau. Despite the similarities of the vestiture of *C. vinacea* to some *C. viorna* forms there are differences in the narrower leaflets and lobes, the sericeous vestiture on the leaves, stem, and sepals, and the distinctly abaxially and adaxially pinkish-purple colored sepals. It is likely that the distribution of this species, which is outside the range of *C. crispa*, has partly contributed to its inclusion within the sympatric *C. viorna*. Nonetheless, the phenology of *C. vinacea* begins in early spring (see type collection date in late March) and flowers throughout the growing season whereas *C. viorna* begins flowering in late May where the two are sympatric. Both *C. vinacea* and *C. viorna* share plumose achene tails, however, the achene tails are gold plumose in *C. vinacea* whereas they are typically brownish to whitish in *C. viorna*. Notwithstanding the confusion of this new species with *C. viorna*, the presence of the terminal ebracteate inflorescences, sepals colored on both surfaces, and growth habit suggests a close phenetic relationship to *C. crispa*. Despite their shared morphology, the plumose achene tails, leaf indument that is usually lacking in *C. crispa*, and the only slightly crispate sepal margins of *C. vinacea* differ strongly from *C. crispa*.

This new species falls within *Clematis* subg. *Viorna* Gray based upon the thick, leathery connivent sepals

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which are urceolate and usually pendent (Pringle 1997). A common vernacular name for the group is "leather-flower." *Clematis* (Ranunculaceae) is a large genus comprising approximately 350 species (Wang 2005). Infrageneric classifications have been based partly on floral morphology (Tamura 1967, 1995; Keener & Dennis 1982), floral and leaf morphology and plant growth habit (Erickson 1943), and a combination of the above and eophyll orientation (Yang & Moore 1999; Wang 2005). Wang's (2005) recent subclassification recognizes subgenera, subsections and series, of which our southeastern leather-flowers would fall under *Clematis* subg. *Viorna* A. Gray, sect. *Viorna* (Reichb.) Prantl, subsect. *Crispae* Prantl which is subdivided further into five serial divisions. Pringle (1997) includes 25 species in *Clematis* subg. *Viorna* with 18 of these present in North America. I follow this broader subclassification. As part of a revision of the North American *Clematis* subg. *Viorna* (Estes, Floden, & Witsell, in prep.), examination of herbarium specimens and cultivation of nearly all eastern North American *Clematis* subg. *Viorna* have provided data supporting the recognition of *C. vinacea*, which appears to be endemic to a small region of the southern Appalachians.

TAXONOMIC TREATMENT

Clematis vinacea Floden, sp. nov. (**Fig. 1**). Type: United States. TENNESSEE: Polk Co.: Ocoee River, shale banks along Hwy 64/40, just west of Caney Creek around bend on N-side of road on moist phyllite talus slopes that tend towards subxeric during summer, anthesis early spring and continuing through summer when moisture is available, 27 Mar 2012, *A. Floden 1942* (holotype: TENN; isotypes: APSC, BRIT, MI, MO, NCU, NY, TENN, UTC, others to be determined).

Differs from *Clematis viorna* in the presence of terminal flowers without bracts; and differs from *C. crispa* in its sericeous pubescence, plumose achene tails, minimally expanded or non-expanded sepal margin, and upland subxeric habitat preference vs. the bottomland, floodplain habitat of *C. crispa*.

Plants: perennial from a rootstock with several thick roots, frequently with short horizontal rhizomes, some plants with 2 or more stems; stems 25–150+ cm, erect early in season becoming scandent to vining later, stems 6 angled, 12 ribbed, castaneous, shortly sericeous to glabrate in age. **Leaves:** opposite, decussate, imparipinnate to pinnate-ternate, largest at midstem, spreading, to 1–3 dm long, longer than wide; petioles slender, subequal to lowermost leaflets, 1–6 cm long, sericeous pubescent; leaflets symmetrical or asymmetrical, 8–12 cm long on imparipinnate leaves, to 30 cm on midstem pinnate-ternate leaves, leaflets 3–5-lobed, rarely unlobed, or 3 foliolate, 3–7 × 1–3 cm, bases cuneate to rounded-truncate, apices abruptly obtuse-mucronate, texture chartaceous, proximal leaves with narrow segments frequently less than 1 cm, reduced on rachis, sometimes terminating in a tendril-like petiolule with a small elliptic leaflet; shortly sericeous abaxially, sometimes sericeous adaxially, margins ciliate, revolute. **Inflorescences:** terminal (primary stem or branch), ebracteate, 1-flowered, branches with inflorescences borne from base of terminal peduncle sometimes bracteate in late season stems, bracts ovate to trilobed, 0.5–2 cm. **Flowers:** bisexual; sepals 4 erect, valvate, connivent, oblong, oblanceolate, perianth urceolate; sepals colored adaxially and abaxially, pinkish-purple, reddish or pinkish, drying brownish, apices lighter pink, green or white; densely sericeous; 1.5–3 × 0.6–1.5 cm, ovate-oblong, apex acuminate, recurved, margins white sericeous; stamens linear, filaments flattened, anthers oblong or narrowly oblong, 4–5 mm long, connectives pubescent to apex, extended 0.5–1.5 mm beyond anther; stigmas 10–14 mm long, apex papillose and curved, plumose. **Infructescences:** spherical, 3–7 cm diam., achene tails curvate, plumose trichomes golden. **Achenes:** flattened, orbicular, brown, shortly sericeous; 4–6 mm, tails 3–5 cm, trichomes to 5 mm proximally, shorter distally.

Flowering: March-September, fruiting June–October.

Other specimens examined: **GEORGIA. Murray Co.:** 29 Apr 1986, *N.C. Coile 4621 w L. & G. Foote, S.B. Jones, & H. Currie* (TENN). **TENNESSEE. Polk Co.:** Ocoee River Gorge; 9 May 2004, *M. Rhinehart s.n.* (TENN); 8 Jun 1958, *A.J. Sharp, F.H. Norris, & N. Russell 23650* (TENN); 21 May 1961, *A.J. Sharp & J.S. Pringle 28541* (TENN); 3 May 1989, *V.E. McNeilus 89-208* (TENN); 9 May 1977, *E. Wofford & D.H. Webb 77-62* (TENN); 19 May 1963, *Mr. & Mrs. A.J. Sharp, G. Jones, C. Varner, & G. Ramsey 31297* (TENN); 5 Jun 2009, *A. Floden 913* (TENN); 10 May 1959, *G. Carter & R. Houk 25778* (TENN); 10 May 1959, *G. Carter & R. Houk 25770* (TENN); 20 May 1986, *E. Schell s.n.* (TENN); 1 May 1976, *T.S. Patrick & R.W. Simmers s.n.* (TENN); 18 Apr 1980, Hiawassee River Gorge; *W. Manek 88* (TENN); 17 Apr 1949, *A.J. Sharp, C.J. Felix, & B. Adams 11369* (TENN).

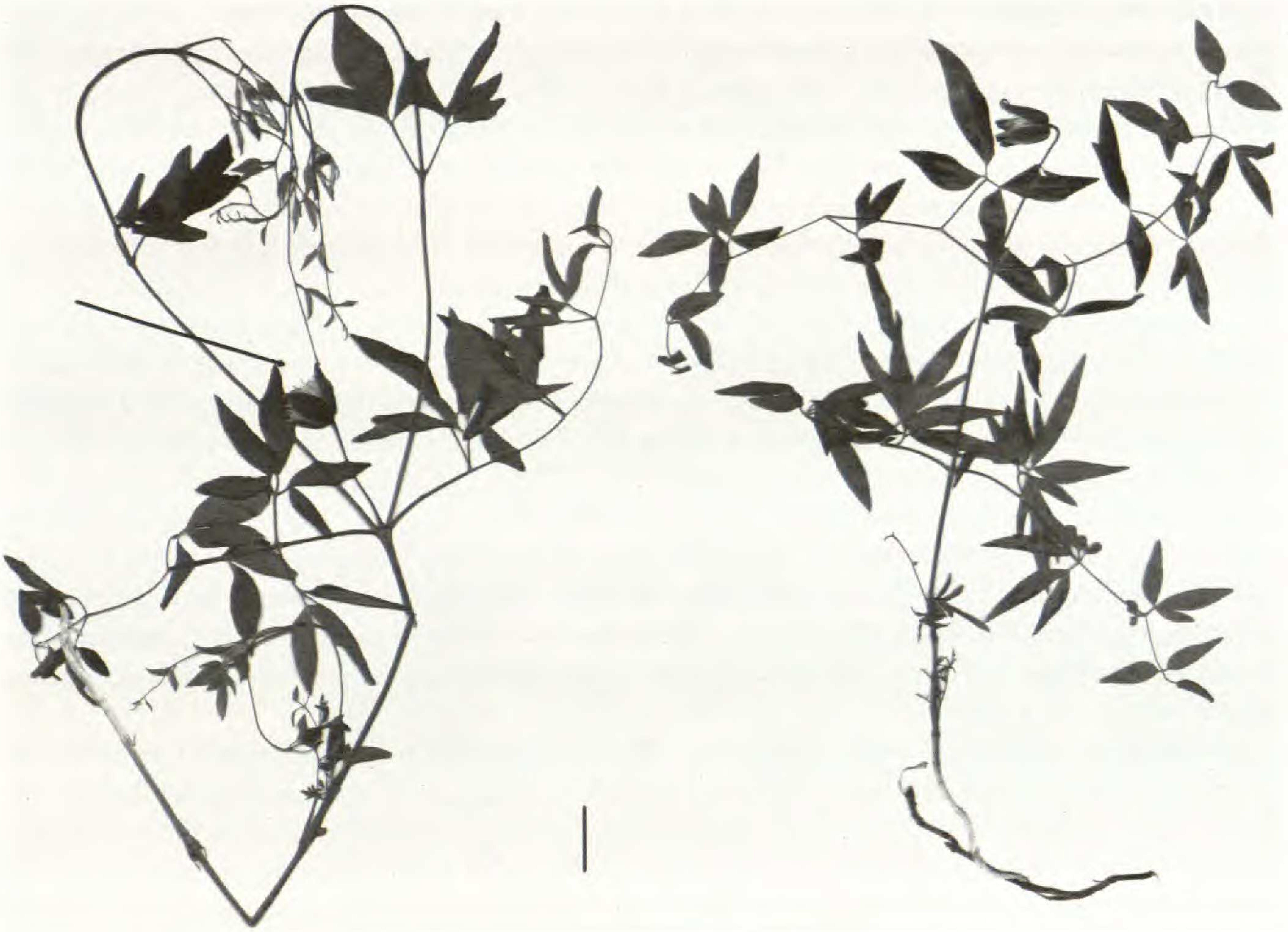

Fig. 1. Holotype (left) and an isotype (right) of *Clematis vinacea* at TENN. The holotype shows the axillary buds that become scandent at the base of the terminal inflorescence and the isotype shows the distinctive rhizome. Scale bar = 2 cm.

DISCUSSION

Living material of *Clematis vinacea* was first observed by the author in early June 2009 that was in anthesis while also bearing nearly mature gold-plumose achenes. Notable features were the dense sericeous pubescence of the pinkish-purple sepals, stem and leaves, and the leaves with more numerous and narrower leaflets than *C. viorna* (Fig. 1). Although annotations have consistently placed *C. vinacea* within the concept of *C. viorna* or *C. crispa*, specimens of *C. vinacea* at TENN are easily segregated from the former by their terminal flowers borne on ebracteate pedicels and narrower leaves and from the latter by the sericeous indument of the leaves and sepals and plumose achene tails. Furthermore, the habit of *C. vinacea* due to continued growth in response to sufficient moisture enables the plants to become vining later in the growing season whereas collections early in the season appear distinctly erect with a single terminal flower. A number of collections state the plant as "rather shrub-like" or "erect" which has been observed by the author both *in* and *ex situ*. Observations of *C. viorna* in the field show that its inflorescences are strictly axillary and begin in late May on distinctly vining plants. In contrast, early flowering does occur in *C. crispa*, but the plants are distinctly scandent and glabrous. The late season collections of *C. vinacea*, despite their terminal ebracteate inflorescences, have contributed to the confusion of this species with *C. viorna*.

Based on similarities in morphology and phenology, the phylogenetic relationship of *Clematis vinacea* seems to be with other terminally flowered *Clematis* of subg. *Viorna*; those from the American southwest and southeast. On a phytogeographic basis a close comparison can be made with *C. crispa* rather than the morphologically comparable western *C. hirsutissima*. It shares with *C. crispa*, *C. baldwinii* Torr. & A. Gray, and *C. socia-*

lis Kral several distinctive morphological and phenological characters: 1) ebracteate primary peduncles borne at the terminus of a stem or branch; 2) sepal margins with narrowly to broadly expanded crispate margins; and 3) early-spring flowering. In morphology, *C. vinacea* appears closest to its eastern counterpart *C. crispa*, but the two are easily separated on account of their sepal morphology (narrowly or not crispate vs. broadly crispate) and their achenes (plumose vs. non-plumose), respectively. Comparison of cultivated plants of *C. hirsutissima* also shows similarities: a strongly clump forming habit from a short horizontal rhizome; finely divided lower leaves; and terminal inflorescences, though the indument observed in *C. hirsutissima* is denser than that seen in *C. vinacea* to nearly hoary in some parts of its distribution (Pringle 1997).

Observations of several genets of both *Clematis vinacea* and *C. crispa* cultivated in a common garden reveal that both exhibit similar growth patterns. Both display remontant behavior in response to ideal edaphic conditions where the axillary buds subtending each terminal, single-flowered inflorescence enable continuous growth and flowering throughout the growing season. Populations of *C. vinacea* were observed in flower on vine-like plants from early spring through September during 2009, 2010, and 2012. Field observations in 2011 revealed that during drought conditions *C. vinacea* remains a single stemmed, once flowering perennial. In cultivation *C. socialis* and the western *C. hirsutissima* have not shown any remontant tendency, but have continued limited vegetative growth after their spring flowering. Both are erect perennials with short to long branching rhizomes (Kral 1982). Rhizomes have been observed in several populations of *C. vinacea* where single clones can have up to 12 or more stems separated by several centimeters each (Fig. 1), whereas rhizomes are not present on *C. crispa*.

Perianth morphology of *Clematis* subg. *Viorna* differs little between taxa; all are 4-sepaled, urceolate, and valvate and connivent most their length. Perianth color varies between species, and can even vary dramatically within a species, although not usually within a population. *Clematis crispa* has broadly crispate sepal margins and this character has led to its monotypic subsectional status within the broader subg. *Viorna* (Grey-Wilson 2000). Nonetheless, several other taxa not included in this subsectional division are notable for their crispate sepal margins as well: *C. baldwinii; C. socialis; C. hirsutissima;* and some forms of *C. pitcheri* Torr. & A. Gray from the southwestern part of its range. *Clematis vinacea* differs from its phytogeographic neighbors by not having prominent crispate sepal margins. Furthermore, the presence of plumose achene tails differs strongly from the short, glabrous (non-plumose) achene tails on *C. crispa*. Plumose achene tails are shared with *C. baldwinii*, but that species is distinctly erect without a tendency to vine. The presence of the plumose achenes on *C. vinacea* is also a likely contributor to the misidentification of specimens as *C. viorna* because it also exhibits this character and is sympatric in distribution. But, the gold plumose achene tails differ from the typically brownish achene tails of *C. viorna*.

GEOGRAPHIC DISTRIBUTION

The majority of collections of *Clematis vinacea* are from the Ocoee River Gorge, a scenic and much botanized area, but where most collections are confined to easily accessible roadside localities due to the nature of the gorge; steep cliff faces composed of siliceous phyllite slopes that are difficult to access. All known populations in Tennessee are limited to the Walden Creek geologic formation which is a narrow band (<15 km wide) nestled between the Smoky Mountain group geologic formation to the east and west (Hardeman 1966). Within this narrow band along the Ocoee River *C. vinacea* is extremely abundant where road construction has facilitated increased erosion of the slopes and produced an abundance of available habitat. It is known from two areas along the Hiwassee River to the north: near the mouth of the gorge along Spring Creek; and further upriver near the abandoned community of McFarland. A single collection from southeastern Murray Co., Georgia was collected on limestone bluffs above the Coosawattee River (see specimens examined). It is likely that other reported occurrences of *C. crispa*, and potentially *C. viorna*, from dry habitats in northernmost Georgia are *C. vinacea*.

In addition to differing in morphology, *Clematis vinacea* and *C. crispa* occur in distinctly different habitats. *Clematis vinacea* is a plant of relatively dry talus slopes, cliff ledges, calcareous-phyllite woodlands, and

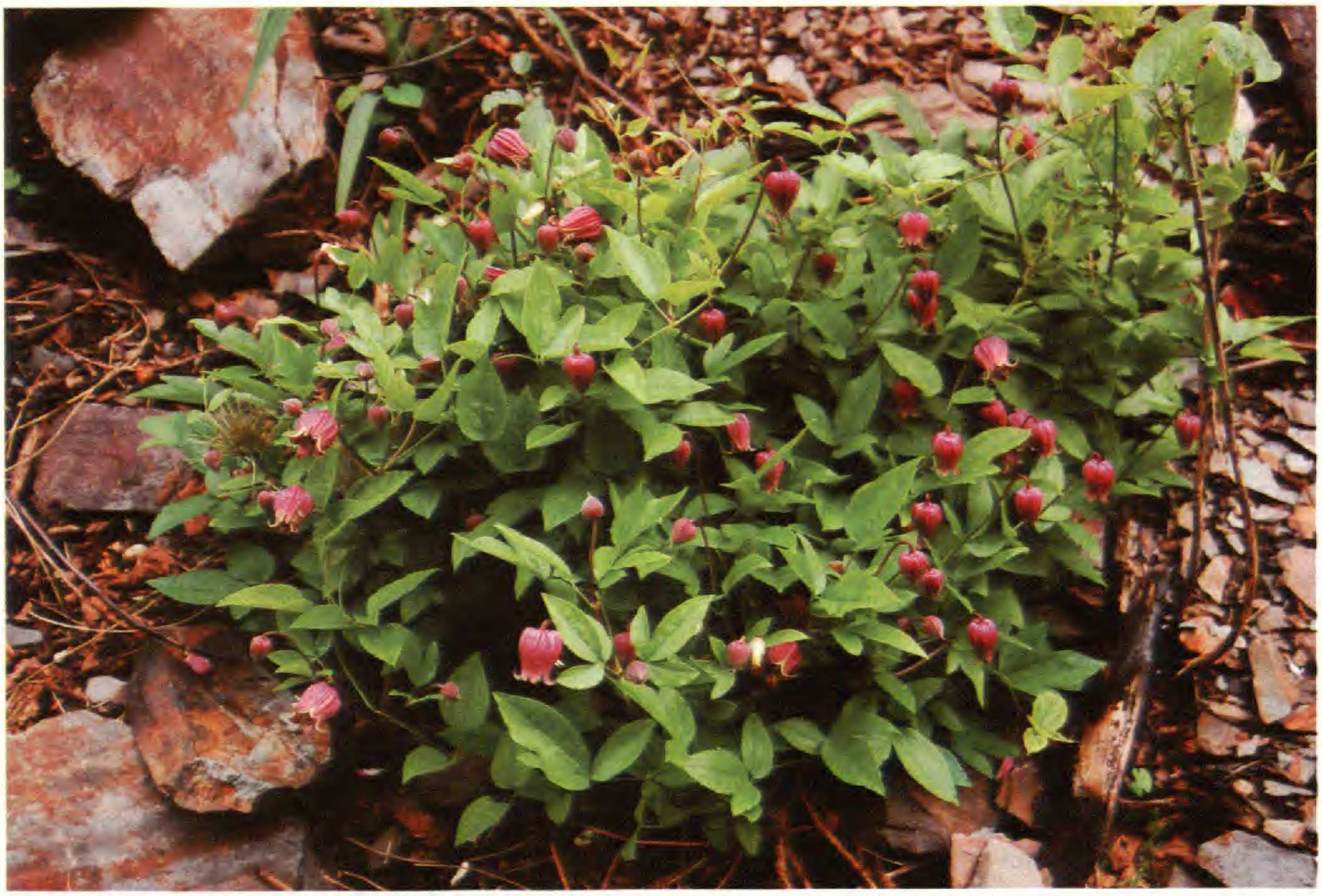

Fig. 2. *Clematis vinacea* in flower after early summer wild fires in situ, August 2012 (Photo: A. Floden).

bluffs and outside the preferred habitat of *C. crispa* which inhabits bottomlands throughout the Coastal Plain of the southeastern United States from Virginia south and west to east Texas and up the Mississippi embayment to Illinois and Missouri.

Within its narrow range, *Clematis vinacea* is sympatric with two native species and one introduced species of *Clematis*. *Clematis viorna* is present on Big Frog Mountain just to the south of the Ocoee River at higher elevations and is also present along the Hiwassee River to the north. *Clematis viorna* is not known to occur syntopically with *C. vinacea* on either river system. I have observed *C. viorna* in only two locations along the Hiwassee where it occupies distinctly different habitats from *C. vinacea*; particularly mesic riparian zones where it often scrambles through low shrubs. *Clematis glaucophylla* Small is rare in Tennessee, but at one site along the Ocoee River it is growing within a few meters of a large population of *C. vinacea*. Throughout the Ocoee River Gorge the introduced and invasive *C. terniflora* DC is abundant with populations of *C. vinacea*.

The southern Appalachians, including the Ocoee and Hiwassee River areas, are notable for numerous rare and endemic taxa, e.g. *Coreopsis latifolia* Michx., *Gaylussacia ursina* (M.A. Curtis) Torr. & A. Gray ex A. Gray, *Pityopsis ruthii* (Small) Small, *Pycnanthemum curvipes* (Greene) E. Grant & Epling, *Sedum nevii* A. Gray, and *Vaccinium hirsutum* Buckl. (Harper 1941; Wood 1970). Additional taxa that appear to be endemic to this area are undescribed species of the genera *Stachys* and *Monarda* (Floden, in prep.). The Ocoee River and Hiwassee Rivers in Tennessee also support numerous rare taxa, some of which are not shared between the two river systems: *Lysimachia fraseri* Duby, *Helianthus smithii* Heiser, *Isoetes tennesseensis* N.T. Luebke & J.M. Budke, and *Viburnum carolinianum* Ashe. Most of these are known from the Walden Creek geologic formation where *Clematis vinacea* is found.

The summer of 2012 offered a glimpse at an ecological adaptation of *Clematis vinacea* to its subxeric habitat. Early summer drought led to wildfires in June in a large portion of the Ocoee River Gorge habitat where *C.*

vinacea occurs. Most of the shrubby layer was killed to the ground and many herbaceous plants were killed outright. Surprisingly, *C. vinacea* responded quickly to mid-summer rains and was in full flower by mid-August as the predominant plant in several burned areas (Fig. 2). Excavation of several plants showed the root crown was positioned 15–20 cm below the soil surface. The deeply positioned root crown is likely an adaptation to the subxeric habitat that also provides protection from the occasional fire.

SUGGESTIONS FOR COLLECTING *CLEMATIS* SPECIMENS

A lack of material or too much plant material folded over itself on herbarium specimens can obscure the distinct characters of a collection of *Clematis* subg. *Viorna*. Morphology can also be misinterpreted when material for preservation is taken from the proximal to middle part of the stem rather than a terminal section. Therefore, collectors should note from which part of the plant the material has originated if it is not obvious, especially the vining taxa, and also seek to press the whole stem in sections. The position of the bracts on the peduncle should not be obscured by the leaves. Furthermore, the perianth color of *Clematis* herbarium material is usually masked upon desiccation by turning brown (Keener 1975; Dennis 1976). Variation in color of the sepals can differ between early season flowers and those produced later in the season. I have observed this *in situ* and *ex situ* which has also been confirmed by D. Estes (pers. comm.). Noting the color, or providing a photograph of the sepals, despite their variability, is useful in some groups, e.g. Glaucophylla-group, and Viorna-group.

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